Pigott, D., Hobbs, V.J. and Gammack, J. (2008) A knowledge development lifecycle for reflective practice. In:Burstein, F., Linger, H. (eds), Integrating 'Doing' and 'Thinking': Knowledge Management as Reflective Practice, Australian Scholarly Publishing Pty Ltd, Melbourne Vic Australia. Pp 41-53.

A Knowledge Development Life Cycle for Reflective Practice

Diarmuid J. Pigott

School of Information Technology
Murdoch University
Murdoch, WA 6150
d.pigott@murdoch.edu.au

Valerie J. Hobbs

School of Information Technology
Murdoch University
Murdoch, WA 6150
v.hobbs@murdoch.edu.au

John G. Gammack

School of Management
Griffith University
Nathan, QLD 4111
j.gammack@griffith.edu.au

Abstract

Reflective practice is valuable because of its potential for continuous improvement through feedback and learning. Conventional models of knowledge practice however do not explicitly include reflection as part of the practice, nor locate it in a developmental cycle. They focus on modelling in a knowledge plane which itself is contextualised by active knowing processes, and ignore the influence of power in their activity models. Further, many models focus on either an artefact or a process view, resulting from a conceptual disconnect between knowledge and knowing, and failure to relate passive to active views. Using the idea of higher order loops that govern knowledge development processes, in this paper we propose a conceptualisation of a reflective Knowledge Development Life Cycle (KDLC). This explicitly includes the investigator and the organisation itself as dynamic components of a systemic process and is suited to either a constructivist or realist epistemological stance. We describe the stages required in the KDLC and discuss their significance. Finally we show how incorporation of reflection into process enables dynamic interplay between the *knowing* and the *knowledge* in the organisation.

Introduction

Reflection on practice is well established in the organisational learning literature, notably in the work of Argyris and Schön (1978) who follow Ashby's (1960) original ideas as later developed in Bateson's (1973) concept of deutero-learning. The systems thinking influence was subsequently elaborated in Senge (1992). The central idea that makes reflection possible is building a level of self-consciousness about active behaviour at a lower level. From the cybernetic idea of a single feedback loop, (as with a thermostat), learning involves a second loop regulating the appropriate application of that behaviour, and more complex structures can be modelled as processes interact positively and negatively.

Whereas Senge's models deal with archetypes and particular common patterns of feedback loops, a higher order loop construct allows a reflexive context to consider options and enable construction of a hierarchy (or holarchy) within which given levels of activity can be appropriately modelled and scoped.

Beyond deutero-learning, Flood and Romm's (1996b) triple loop idea extends the levels of efficiency (the working thermostat), effectiveness (the appropriateness of the thermostat's setting to the context) to a third level, where greater complexity is introduced – questioning the political forces around why things are constructed in a particular way, and admitting complementarist positions on knowledge construction. There is a distinction between the means-end rule-following of the single loop, the end goal agenda-setting of the double loop and the higher order reflections shaped by power-knowledge dynamics. Flood and Romm (1996a) suggest that such relationships need to be problematised, since to dismiss them as merely ideological causes a systemic disconnect, such that once a problem has been framed, operation at the level of the problem is then ideologically scoped without possibility for a reflective intervention.

The knowledge management literature has largely focussed on the double loop level of knowledge modelling, in which means and ends are externally defined, and outputs matched to states of the world and transformed. For example the SECI cycle of Nonaka and Takeuchi (1995) follows a transformational process that is revised cyclically within its own logic. The contextualising power relations are not included in the model. Cook and Brown (1999) offer a "bridging epistemologies" view where the knowledge as some form of passive commodity takes part in a dance with the active knowing processes. This is a more powerful model, but in itself does not go far enough to serve as a causal description within which activity can be regulated. Reflection for example is knowing-centred, and will select and apply any knowledge artefacts in higher-level awareness of the presenting context. Any focus on the generation of new knowledge that has as its primary focus the artefact will miss this. While the knowledge available constrains what can be done, the active focus required lies in what use is made of it in a knowing context.

The analysis of the KDLC in general terms (as usually carried out) artificially removes the process from the ongoing context of the organisation and of the investigator. This is recognized in the motivations for ethnographic investigation and particularly case studies where closeness to (and thus separability of) phenomenon and context are at issue. For example Evered and Louis (1981) distinguish inquiry “from the outside” and “from the inside” in organisational investigation. Noting the impact of their distinct epistemological assumptions in “knowledge yielding” they advocate increased attention to the role of action in research approaches, and argue for greater self-reflection on investigator assumptions in organisational research, a view shared and elaborated in well known work by Burrell and Morgan (1979), Hirschheim and Klein (1989) and in the action research tradition generally. In our example, the investigator brings lessons learned from one audit to another, the organisation has increased its self-awareness when goes back to its "regular work". Indicating the temporally mutual, categorically separable universes of discourse and focussing on the (system) catastrophic points of joining and leaving around the identified phases of KM allow these systemic nestings to be reflexively generalised.

In this paper we are concerned with how knowledge work gets done, using the example of an extended knowledge audit, which metonymically represents any specific activity in which an organisation’s knowledge management activity is assessed to identify capabilities, gaps, lessons and the like. We see this as typical of any systems intervention, where an external party appraises the state and processes of an organisation in some accountable way. Although we agree with Checkland (1981) that systems interventions are always surrounded by political and multiple interpretations of the problematic, and that ongoing learning and more deeply informed insight is the useful outcome, we also recognise that critics have noted an uneasy conflict in his work between a constructivist and a natural science epistemology.

The epistemological problems with Checkland’s position have been detailed by the Hull school (e.g. Jackson (1982) and Romm, (1994); by Probert (1991) and by Salner (1999). In Checkland’s later work (e.g. Checkland & Scholes, 1990) he accepts a need for a more critical perspective, acknowledging that power in organisations often lies beyond the explicit level of analysis, and tacitly contextualises it. Inasmuch as this entails issues of value that lie outside the system being modelled, it is imponderable, and its handling in SSM is an analyst capability, rather than being given by the model. But if a model representing a “real-world” situation has nothing to say that is relevant to that world, whether realistic or merely provocative of discussion, it is also disconnected from practice, even if it then feeds into further learning

Where we aim to contribute in this paper is in providing a principled basis for modelling knowledge and knowing in a way that both directs and structures the dance implied by Cook and Brown, and at the same time avoiding the epistemological quagmire between constructivists and realist views that bedevils the modelling of politically charged problem situations. We see the artefacts of knowledge being contingent on their contextualised knowing, and, informed by reflective acts that follow activity on the lower plane of analysis, developing along an historical trajectory. We remain moot on whether this history is subjective, organisationally sanctioned or objective and see the framework of understanding that can be brought to a knowledge modelling exercise as being either realist or constructivist. Whichever stance is adopted, the processes of reflection we describe can be implemented equally.

We also recognise that ideas and action can be systemically related: experience gives rise to new constructions whose representations are then contextualised in active contexts. This is the position of Walsham (2005) who rejects ideas of knowledge sharing such that a direct correspondence between knowers is attained. Instead he views producers of knowledge explicating a representation with awareness of its audience, and that audience recontextualising the representation in their own construction, which includes an awareness of the situation of the originator. The status of a knowledge artefact is in relation to its construction, but may also be a realistic model. The matching required by a thermostat, (or by any higher feedback loop that converges to a target through self-correction) or the

more problematic matching by correspondence between a representation and the "real world" may be understood in various ways depending on how the criterion is set. For example a pragmatic fit between the affordances of the model and the demands in the users' context would qualify as a match. In what follows we retain the word "matching" on the basis that it can be implementationally interpreted within different epistemological traditions.

We also propose a lifecycle model for knowledge development. There are several such models in the literature, which may be cyclic, but are not located within a holarchy allowing higher order reflection. The proposal of Bergeron (2003, p. 84) is typical:

1. Knowledge creation or acquisition
2. Knowledge modification
3. Immediate use
4. Archiving
5. Transfer
6. Translation/repurposing
7. User access
8. Disposal

This model embraces the major KM processes and these are linked in a familiar boxes-and-arrows diagram. However, a model such as Bergeron's is not a cycle! It does not include feedback or reflective learning. Other lifecycles, proprietary or otherwise, usually also simplify to something like SECI or simply a generate-share-use or equivalent formalisation. These are variously called the KM lifecycle, the knowledge lifecycle and similar, and some follow Shewhart and Deming's plan-do-study-act quality management approaches to continuous improvement (Deming, 1986). But they all lack mechanisms for higher order reflexivity – often they are purely artefact based, on the plane of knowledge and saying nothing about its active knowing. None includes the knowing subject or knowledge investigator as part of its model, and they are cyclic at the level of their plane, without a holarchic structure to provide a frame of developmental reference, a mechanism to link to the political context, nor even epicycles to manage local development confined within the plane.

The running example used in this paper is a generic knowledge audit and management process, since this comprehensively covers the activities involved in other organisational knowledge projects, and uses the investigator (auditor) as the knowing subject. Essentially audits map knowledge and its gaps for an organisation (or a subunit). These findings are then analysed with a view towards making recommendations for planning or action. As well as any periodic interventions, knowledge auditing can perpetuate itself internally through normal reflection on practice. In the sections that follow we outline a KDLC that makes provision for feedback and learning, and can be located within processes of reflective practice at individual and at organisational levels.

The reflexive KDLC

Unlike the SDLC there is no zero point in a KM investigation. The knowledge artefact is viewed as a revisable human symbolic construction, stretching backwards to the origin of civilisation and reason, and forwards until the extinction of mankind. The understanding of knowledge varies according to the currently enframing context.

For the most part terminology, processes and concept maps employed by a knowing system draws on extant understandings, and part of the commencement of any knowledge audit involves establishing the origins and prior status of such material. In a similar way, the baton of knowledge is passed on the (organisational or intellectual) descendants of an organisation or system, and this is an organisational or community learning activity.

Given this, we can describe three general divisions of a KDLC:

1. The universe of discourse for the organisation
2. The outer KDLC (which is the immediate prior and subsequent relations between the organisation and the universe
3. The inner KDLC, which essentially corresponds to the kinds of tasks met in an SDLC, or in a knowledge cycle on the plane of action.

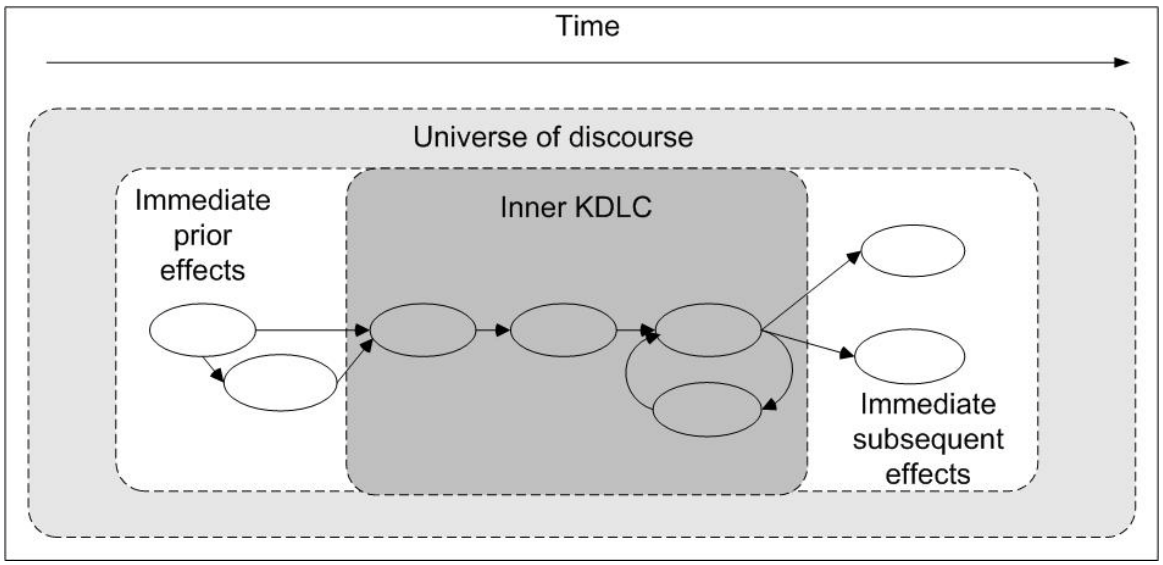

Figure 1. Divisions of a KDLC.

This superstructure is required to allow context for the lifecycle activity, and exchange over time in the universe of discourse. (Bergeron's model, by contrast, has no ability to modify knowledge artefacts based on their usage and requires every knowledge artefact to be created when entering the system. There is no repurposing within the system and thus no reflexivity for the knowledge artefact.) We expand the model as shown to cover the detailed processes, showing feedback loops, and the next sections elaborate this.

We note that there are two aspects to each stage in the KDLC: each stage could be either a one-off occurrence, or a regular occurrence in a continuous review loop. Each of these aspects requires different actions to be taken, since repeating occurrences can refer to previous states in ways that a one off event cannot.

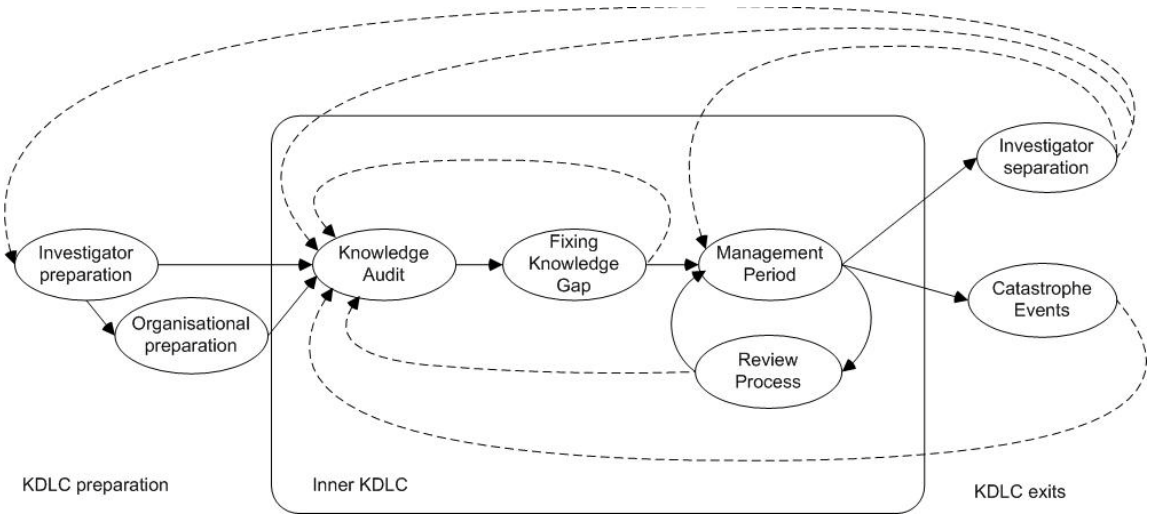

Figure 2. System level KDLC, showing stages within outer and inner KDLC.

Stage 0 – Investigator and organisational preparedness

From the investigator's point of view the investigator is a knowing system. The ability to conduct knowledge audits depends on the maturity and competence of the practitioner and therefore the two KM levels (artefact-level and knower-level) also apply to him/her.

For any two knowledge systems to interact, care must be taken to establish congruity. This involves preparation beforehand to ensure matching, and also monitoring during the process to ensure continuity and consistency. It is not possible for one system to influence another without itself being influenced. Mutuality applies, such that whenever a trained investigator is undertaking a knowledge audit, the investigator's own microcosmic knowledge system also comes into a position of review, though its perturbation should be less and to avoid a vicious circle some checks might apply. The organisation also must be at a sufficient level of maturity and readiness for a knowledge audit to be worthwhile.

For reflective practice the investigator must be epistemically situated. In the context of history and prior knowledge the KDLC begins with the investigator preparing himself or herself for the audit. A clear self appraisal and documentation of the state of his/her knowledge base with respect to the particular task is required (Figure 3). "The researcher's subjectivity is viewed not only as inseparable from the process of construction and production of data, but also as a resource in its own right in the knowledge-gaining process, provided, however, that researchers remain critical of their own approach and constantly exhibit a reflective attitude toward its underlying postulates" (Poupart et al., 1997), cited in (Diaz, 2005).

Analogously, the organisation should be situated in the context of history and prior knowledge, making an initial, holistic appraisal of the organisation being appraised at the level of the organisation itself rather than an aspect or business unit. Both are inputs to the knowledge audit process.

How we use words, make judgements, call up things form memory is in itself a matter of reliance on unspoken assumptions, qualifications, and ontological frameworks. We can only proceed with an analysis of the exterior when the interpreting mechanism (the investigator) can recognise all manner of contextualisations from conflicts of interest to unexpected synergies. The investigator will not present *ex nihilo* for the investigation, but will have prior work, social relations, and other framing experiences. Disclosed antithetical points of view can be of assistance as well, and it is of paramount importance that the investigator's use of words within a context is sufficient to permit this occurrence.

We need a system of self-representation for the investigator. Will a common representation for investigator (microcosm) and system (macrocosm) be sufficient? Systems theory suggests that it should be, since we have a common requirement (accounting for and describing the knowledge inherent in a system). Either way, we need to have a system of matching the investigating system with the target system, but given both are infinitely complex this requires some practical scoping, aiming to integrate the investigator's state with that of the organisation as audit proceeds.

Establishment of whether or not there is sufficient basis for engaging in a KM process is obviously fraught with difficulties, and there cannot be a simple checklist that covers all aspects of the evaluation – indeed it could be argued that as the process of KM is in part intended to bring about a self-awareness in the organization, then it would be paradoxical to expect sufficient self-awareness in the organization to recognize readiness. But again, the reflective methodological approach can help in constructing such a list.

These difficulties are implicit in every study of any community, and the required bounds for establishing the subject of an investigation are that there be a clear idea of the unity in some form of the area of study, that there is a continuous body of discourse within the community to warrant examination, that there be a reference structure in place that provides the horizon against which statements regarding the organization or the world around it are made.

Part of the participant-observer methodology is the familiarization of the investigator with the cultural artefacts present in the subject of investigation, which are the best representation of how that community sees itself, its implicit reflexive process. When the observer is in the context of an organization engaging in a KM audit, these cultural artefacts are most readily encountered in the form of (formally or informally, publicly or covertly) published documents. That is not to say that *all* of the organization's awareness or self-reflexive examination is present in the body of documents, but rather that the most immediately accessible and objectively referable points of reference are in those corpora.

In a knowing community we also expect systematic use of terms and an equally systematic process for creating new documents to show a degree of coherence. If there is a process whereby new cultural artefacts come into being, it lessens the likelihood of chaotic or haphazard creation of new knowledge-bearing artefacts that are misrepresentative of the knowledge capital of the enterprise. An understanding of what documents exist, who made them, why they were made and under what circumstances they are modified or destroyed are good indicators as well.

Equally important as preparedness are the establishment of the grounds for separation of investigator and subject – we need to have a clear understanding that the organization is sufficiently coherent to make a report to, that there is an individual or set of individuals to whom comment can be made or discussion addressed.

There are, of course, a matching set of requirements for the investigator – s/he must be capable of the same scrutiny and accountability as the organization, and that such competences as are required for the task in hand be clearly observable in prior work or qualification.

A checklist showing requirements applicable to both investigator and organization as knowledge systems is shown in Table 1[1]. This is not to say that all of these are mandated, but rather that they provide a clear indication of likely failure or success – it is not that presence will assure a successful outcome, but rather that absence of any of one of these is both a cause for concern about the feasibility of the KM work, and an indicator of immediate tasks to be carried out in the KDLC. In fact it could be said that in many organisations in which KM work is carried out quite a few of these will be only partly present (document protocols) or multifarious (conflicting chains of command, conflicting sections of the workforce). But these criteria then serve as good indicators of the problematic areas for an investigation.

Requirement	Organisation	Investigator
Metadata policy	Published, standardised and adhered to	Explicit, standardised and adhered to
Systematic approach to document creation	Mandated situations for creating documents and mandated procedures for how to go about it	Regularised self- and client-centred document creation processes
Common term set (vocabulary or ontology)	Published set adhered to, preferably in conformance with industry standard	Established terminology practice, combined with ability to incorporate terms local to client system
Understanding of organisational needs	Organisational aim (or aims) unambiguous and clearly stated	Distinction between investigator as individual and investigating role in KDLC project

[1] One of the authors was involved in Y2K and the checklist emerged from that experience as being generally useful; although it would obviously have to be validated in further research.

Clear statement of needs at the operational level	Telos for organisation expressed in practical terms as (e.g.) a mission statement	Explicit methodology including (this) KDLC
Systematic naming process for documents	Naming and locating of documents carried out systematically in accordance with a rule set	Naming and locating of documents carried out systematically in accordance with a rule set, with a set of referends to internal processes and external systems under investigation
Chain of custody for documents	Responsibility for document clearly established at all times	Strict versioning and security
Clear process for decision-making	Chain of command and ultimate responsibility	Explicit authorial or editorial responsibility
Awareness of structure of organisation	Unambiguous logical schema for organisation	Individual or team based expert identity
Documentation of processes (minutes, memos etc)	Organisational procedures published and adhered to	Regimen of journalling work and research strictly adhered to

Table 1. A checklist to assess maturity of investigator and organisational knowledge capability.

Stage 1 – Formal knowledge audit and gap fixing

This is the first part of the 'inner' KDLC. The knowledge audit will follow standard processes involving such things as identification of needs, gaps or blockages, extant tools, processes and policies, locations flows and sources, leading to establishment of recommendations, and perhaps cost-benefit analysis of indicated changes to organisation. Many well known approaches can guide specific actions on this, but we distinguish here between a continuous version and a periodically scheduled one. A cost-benefit analysis can determine the frequency, as the context of the organisation changes daily. Strategically, making any knowledge system built partially reflexive and adaptive, means that it can effectively do its own audit.

The next stage, 'Fixing the gap', is a response to the intelligence gathered at audit, in which gaps are fixed, plans made and a reintegration occurs. Activities and tasks are modelled holistically, and data and metadata reintegrated as appropriate technically and socially. This will ensure standard metadata practices across the organisation for the explicit knowledge involved. It is a matter of organisational culture as to how detailed this becomes, and how much should be enforced. There is a feedback loop at this stage back to the audit/checking activity.

The audit process interfaces with the environment identifying any gaps or blocked flows in required knowledge, and the costs and benefits of addressing these. Fixing the knowledge gaps would involve specific activities, such as standardising data for general usage (as in data warehouses), cleaning or preparing data sets or other information inputs needed operationally, and tagging metadata consistently if this is shown to be beneficial. This builds reflection and adaptivity into the system at a higher level, and this itself may be partially automated.

Stage 2 – Management and review

This is the normal operating state for a knowledge (management) system. For example on a daily basis this refers to when a KMS is actively consulted, and is guiding procedures within an

organisation. Or, when it is cultivating new knowledge artefact creation when new documents are produced. Or when knowledge capital is effectively being increased every time work is done within the system, or libraries or other sources are acquired. These systems have their own update and ongoing maintenance processes. However review is also required to ensure the integrity and currency of the system. This is another formalisation of reflection within the KDLC. As well as assessing normal technological aspects of the system such as techniques and implementations for their power and efficiency, managerial processes are also needed. These processes assess for example whether the knowledge still reflects practice, whether it still matches the world or relevant model of the world (in any important way), and is still viable within the current political/social framework. There is continuous feedback between the management and the review processes, and review also feeds into the knowledge audit.

Stage 3 – Separation

Stage 3 is where the knowledge development lifecycle is transcended. Firstly we consider investigator separation, since there must be a satisfactory exit strategy for the investigator. (If there is none, the system can't be assured of continuing functionality if something unexpected happens.) There has to be a process of review within the KDLC of the investigator, who also has to be a free agent if not an employee. The timing of any exit is important. The natural exit strategy consists of a documented handover process, enabling someone to carry on the work inside the organisation

The KDLC is designed with continuity in mind: when things go wrong, they are "catastrophes". Catastrophe events can also cause an unnatural ending to the KDLC, necessitating a higher order reconceptualisation of the loops within the KDLC. This can occur through events in the wider environment or universe such as merger, extinction, takeover, diversifications and so on, all of which require a new knowledge auditing process to begin.

Conclusion

We have sought in this paper to locate the techniques of knowledge management within a systemic framework that closely couples the doing and thinking aspects of knowledge development. By conceptualising the investigator as a knowing system, the relationship between the political, contested and power structures and the knowledge as audited is made more transparent, and its scope in relation to these is clarified. We have associated generic processes in loops that have a holarchical structure suited to reflective practice within either a realist or a constructivist epistemology.

In our model we have made provision for political context, which, while itself complex, plural and problematic, at the touchpoint of an "audit" activity will have settled on terms of reference, policy decisions, and a unitary agenda and channel through which to prosecute the audit. Political context is thus represented here metonymically by the investigator – this allows a formal connection between a subjective, knowing, partial and agendised "knowledge describer" that is located in a higher or privileged level to the operations under investigation. Because this structure conveys the potential to shape, select and arbitrate on the operational level, the word political is used here, since a political process is at work.

The KDLC proposed represents the lifecycle process as a system within its wider environment. In the inner KDLC the processes of management and review are effectively those in the familiar SECI cycle of normal activity and working life, guiding knowledge discovery, storage and sharing activity and maintaining currency through review processes guiding use or disuse. The other lifecycle processes, audit and gap-fixing, placed this within a wider system concerned with strategic planning and in the context of more general organisational positioning. These activities comprise unreflective, everyday KM practice, with its own levels of reflection, explication and communication that generate the stuff that is at issue in an audit.

The normal everyday KM activities, document, people or procedurally realised are completely subsumed at that inner level – the concept of audit implies a privileged access at a level above that,

while recognising that at BOTH levels there is dynamism, tacitness, sociality and the rest. By making a new systemic level above the purely operational we allow for reflection on the whole process.

The outer four bubbles display inputs and outputs in the external environment. Investigator preparation and organisation preparation are both essential inputs to a knowledge auditing process. We have described an investigator viewing the system for a knowledge audit, basically to represent any external review of an organisation's knowledge assets, processes and systems. This investigator must be conceptually prepared for this task, with background knowledge, experience in what to look for, and self aware in terms of potential bias towards technology or people aspects. The organisation must also be prepared, with a certain level of maturity, self-awareness and viability to make the exercise appropriate. A checklist to help ascertain this was shown in Table 1.

The remaining two bubbles were concerned with outputs and environmental events related to the knowledge lifecycle. The investigator, whether employee or external consultant, will exit the system at some point. Investigator separation involves handing over audit documents and possibly ensuring the self-continuity of normal knowledge processes. There can also be a catastrophe event, which requires a new knowledge auditing process. Companies merging, diversifying, acquiring or being acquired, compliance regulations and other external impacts mean that knowledge processes must be reconsidered at a fundamental level.

While in an organisational context this model would require testing and development through case studies, similar considerations apply in other fields and these provide analogous examples where reflective practice in knowledge production has been studied. Diaz (2005) describes the research on construction of knowledge by security workers at sports venues, and the participation of investigators in understanding a complex domain that cannot be unproblematically observed. The role of identification of preconceptions and assumptions, and the need to understand the lack of univocality, unilocality and unanimity in this real world case is shown dramatically - the venues involved had a massive effect on understanding possibilities for action and expression on the part of the knowledge-holders, and the passing of knowledge from one section to another was hampered. These problems were only apparent when the investigator immersed in the organisation could see the lack of preparedness in the organisation for unified policy and stance, but recognising that "observers are not interchangeable" and constant vigilance, reflection and involved decision making was required.

Introducing similar levels of reflection (and reflexivity) into the processes of knowledge audit, or any higher level KM process is needed to adequately recognise the dynamic nature of knowledge construction to which "scientific observers" are not immune, and by showing the importance of higher order loops in the lifecycle we have made provision for the ignored political elements to become represented in our knowledge models. Ultimately the investigator has "visitor status" in the ontological structure of the knowing community under consideration, and there remain the problems of trust and interoperability of ontological frameworks, although partial immersion goes some way towards mitigating this effect (and facility with just such work is what makes a good knowledge worker). The experience of immersion can bring about a coalescing of reflection and reflexivity for the investigator while engaged, and this is how the investigator can help the knowledge stakeholders to gain a better understanding of their world through improved reflective capability.

References

Argyris, C., & Schön, D. (1978). *Organizational Learning: A Theory In Action Perspective*. New York: Addison-Wesley.

Ashby, W. R. (1960). *Design for a Brain*. London: Chapman and Hall.

Bateson, G. (1973). *Steps to an Ecology of Mind*. London: Paladin.

Bergeron, B. (2003). *Essentials of Knowledge Management*: John Wiley & Son.

Burrell, G., & Morgan, G. (1979). *Sociological paradigms and organisational analysis*. London: Heinemann.

Checkland, P., & Scholes, J. (1990). *Soft Systems Methodology In Action*. Chichester, GB: John Wiley & Sons.

Checkland, P. B. (1981). *Systems Thinking, Systems Practice*. Chichester, Sussex: Wiley.

Cook, S. D. N., & Brown, J. S. (1999). Bridging Epistemologies: The Generative Dance between Organizational Knowledge and Organizational Knowing *Organization Science, 10*(4), 381-400.

Deming, W. E. (1986). *Out of the Crisis*. Boston: MIT Press.

Diaz, F. (2005). Participant Observation as a Tool for Understanding the Field of Safety and Security, Or How I Learned the Ethnographic Approach in an Attempt to Encompass the Complexity of Social Situations. *Champ Pénal [Penal Field], 2*.

Evered, R., & Louis, M. R. (1981). Alternative Perspectives in the Organizational Sciences: "Inquiry from the inside" and "Inquiry from the outside". *The Academy of Management Review, 6*(3), 385-395.

Flood, R. L., & Romm, N. R. A. (1996a). Contours of diversity management and triple loop learning. *Kybernetes, 25*(7/8), 154-163.

Flood, R. L., & Romm, N. R. A. (1996b). *Diversity Management: Triple Loop Learning*. Chichester: Wiley.

Hirschheim, R., & Klein, H. K. (1989). Four paradigms of information systems development. *Communications of the ACM, 32*(10).

Jackson, M. C. (1982). The nature of soft systems thinking: the work of Churchman, Ackoff and Checkland. *Journal of Applied Systems Analysis, 9*, 17-28.

Nonaka, I., & Takeuchi, H. (1995). *The Knowledge-Creating Company*. Oxford: Oxford University Press.

Poupart, J., Deslauriers, J.-P., Groulx, L.-H., Laperriere, A., Mayer, R., & Pires, A. (1997). *La recherche qualitative*. Canada: Boucherville.

Probert, S. K. (1991). *A Critical Study of the National Computing Centre's Systems Analysis and Design Methodology and Soft Systems Methodology. (Masters thesis)*: Newcastle upon Tyne Polytechnic.

Romm, N. R. A. (1994). Continuing Tensions Between Soft Systems Methodology And Critical Systems Heuristics *University of Hull Centre for Systems Studies Working Paper No. 5*.

Salner, M. (1999). Beyond Checkland & Scholes: Improving SSM. *Plenary talk at 17th International System Dynamics Conference, 1999 Wellington NZ http://www.systemdynamics.org/conf1999/PAPERS/PLEN3.PDF*.

Senge, P. (1992). *The Fifth Discipline. The Art and Practice of the Learning Organisation*. Adelaide: Random House Australia Pty Ltd.

Walsham, G. (2005). Knowledge Management Systems: Representation and Communication in Context. . *Systems, Signs & Actions: An International Journal on Communication, Information Technology and Work, 1*(1), 6-18.